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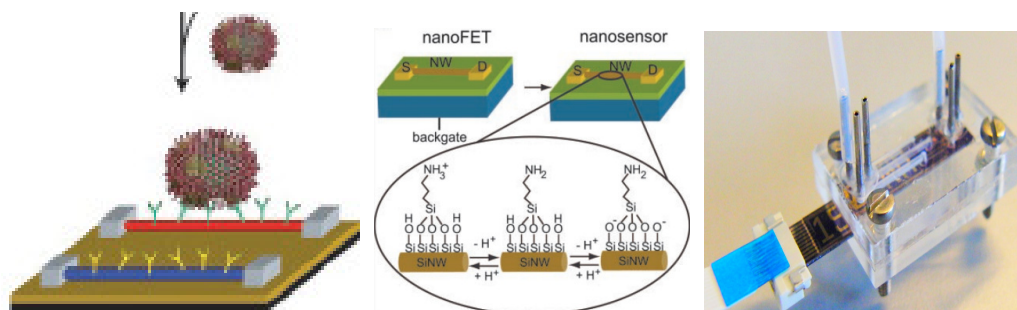
## Lab-on-Chip Silicon nanowire biosensors, for biomedical applications

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Low-cost point-of-care medical diagnostic devices are of crucial importance for the future health care system. Lab-on-chip (LOC) systems with silicon nanowires (SiNW) in a Field-effect transistor (FET) setup can be used as biosensors.<sup>[1]</sup> Due to its high sensitivity and compatibility with a number of LOC technologies SiNWs can be used in a variety of setups, making it an excellent candidate for biosensor devices. In biosensing applications, SiNWs can be functionalized, e.g. with specific antibodies, to ensure selective sensitivity towards a certain target.<sup>[2]</sup> Detecting small amounts of antigens can for example allow for the diagnosis of diseases in their early stages. Single virus detection using SiNWs has been previously demonstrated<sup>[1]</sup>, opening the possibility of extremely sensitive diagnostic tools. However, in order to develop a reliable and reproducible diagnostic tool, it is of outmost importance to truly understand the effects that lead to the high sensitivity that can be achieved with these devices.



**Figure 1 :** Left Virus detection with antibodies of nanowire FET<sup>[1]</sup>, Right Picture of SiNW chip and LOC flow cell setup<sup>[2]</sup>, Middle schematic of functionalization of biosensor<sup>[3]</sup>

In this work we present a thorough study and characterization of SiNW sensors using techniques such as impedance, fluorescence microscopy, SEM and TEM. Impedance measurements on one side can be used to monitor changes in the electrical properties, while microscopy techniques provide detailed information of binding events and surface changes during each step in the functionalization procedure of SiNWs. Furthermore, the fabrication process of SiNW is optimized and carefully monitored to improve not only charge carrier dynamics for better sensitivity but also structural compatibility of different materials which helps integration of the biosensor into a microfluidic system.. The results obtained in this work give a better understanding of the electronic properties and hence enables the development of even more sensitive sensors for rapid disease diagnostics.

### References:

<sup>[1]</sup> Patolsky et al, *PNAS*, vol. **101** \_ no. **39**, (2004), p. 14017–14022

<sup>[2]</sup> G. Z. Fernando Patolsky and C. M. Lieber, *Nanowire-based biosensors*,

**American Chemical Society**, (2006).

<sup>[3]</sup> M. Jørgensen, *Silicon Nanowire Biosensor System*, Master thesis DTU Denmark